

Forest Products

Eco-labeling, Product Category Rules and Certification Procedures Based on ISO 14025 Requirements

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* Corresponding author (annik.fet@iot.ntnu.no)DOI: <http://dx.doi.org/10.1065/lca2006.01.237>**Abstract**

Goal, Scope and Background. The goal of the present paper is to demonstrate how environmental product declarations (EPDs) are developed based on a set of product category rules (PCRs) in accordance with the requirements in the ISO 14025-standard. This is demonstrated by examples from the furniture industry in Norway, where several case models are evaluated. To ease the capability of developing EPDs in this industry, a database with specific environmental data for materials in furniture is developed. The database is used to produce the LCA for selected furniture models, and further, the database is the backbone of a data-assistance tool used to create the EPDs.

Methods. The LCA-data are produced based on traditional LCA-methodology. The PCR is based on a stakeholder analysis and the proposed methodology in the ISO 14025-standard. The EPDs developed so far, are results of close collaboration between companies and research centres in the Nordic countries. For the verification of the EPDs, auditing methodologies are used as a part of the audit of the companies' environmental management systems (EMS).

Results and Conclusion. Based on a hearing of a set of suggested PCRs, a consensus document for seating accommodation is developed. This is further the model for how to develop PCR-documents for all types of furniture, for example sleeping accommodations. Likewise, the database shall contain the most important data for the parts of a furniture model. Within the goal of the project period, EPDs will be developed for 80% of Norwegian furniture. The verification of the EPDs is done as a part of the certification procedures of EMS in accordance with the ISO 14001.

Recommendation and Perspective. The results presented in the paper are mainly for the pilot models in the project. However, the results will be further tested and the data-tool will be developed as a part of a product design tool where environmental requirements will be combined with quality requirements. The product design tool will be implemented in the furniture industry. Information on how to use EPDs in public purchasing will also be a part of future work.

Keywords: Database; design tool; environmental product declarations (EPD); furniture; life cycle inventory (LCI); product category rules (PCR)

Introduction

Sustainable consumption and production patterns are on the national agendas of many progressive countries. However, to make consumers and the purchasers in the public sector and in private companies able to choose the best alternatives, documentations on the products are needed. Compa-

nies, especially for Small and Medium-sized Enterprises (SMEs), are facing a great challenge in meeting the different requirements for documentation.

There are different types of environmental information on products. According to the ISO 14000-series, these are Type I-programmes (ISO 1999a) (multiple criteria-based, third party programmes awarding labels claiming overall environmental preferability), Type II-programmes (ISO 1999b) (self-declared environmental claims, requires that life cycle considerations be taken into account) and Type III-programmes (ISO 2004). Type III requirements are both to conduct an LCA of the product in accordance with the ISO 14040-standards, and to get an approval of the LCA, and a third party verification of the declaration. The information should enable comparisons between products fulfilling the same function.

Various names are used for Type III-programmes and apurtenant product declarations, e.g. EcoLeaf (JEMAI 2002), eco-profile (Tillmann 1998), environmental declaration of product (KELA 2005), environmental product declaration (EPD) (Sirii 2002) and environmental profile data sheet (Row and Wieler 2003). In this paper, Type III EPD is used to refer to a product declaration belonging to a Type III EPD programme. For simplicity, they are sometimes also referred to as an EPD and EPD programme.

1 Goal and Scope

The goal of the present paper is to demonstrate how environmental product declarations (EPDs) are developed based on a set of product category rules (PCRs) in accordance with the requirements in the ISO/DIS 14025.3 (ISO 2004). The PCR states the information that must be included in EPDs for a specific product category, in addition to the general rules for EPDs. This is demonstrated as examples from the furniture industry in Norway where several case models are evaluated. To ease the capability of developing EPDs in this industry, a database with specific environmental data for materials used in furniture is developed. The database is used to produce the LCA for selected furniture models, and further, the database is the backbone of a data-assistance tool used to design and present the EPDs. The goal, furthermore, is to demonstrate how LCA-data, PCRs and EPDs can be verified according to a set of requirements. Presently there are no guidelines for verification of EPDs. Thus, the

project may provide information on how the industry as well as the programme responsible would like such a system to function.

2 Methods

The LCA-data are produced based on traditional LCA-methodology (Guinée et al. 2002). The PCR is based on a stakeholder analysis as required by the Industry Foundation for Environmental Declarations in Norway (NEPD 2004) and the proposed methodology in the ISO/CD 14025-standard (ISO 2003). The EPDs developed so far are results of close collaboration between companies and research centres. For the verification of the EPDs, auditing methodologies according to ISO 19011 (ISO 2002) are used as a part of the audit of the companies' environmental management system (EMS). The data-assistant tool for the EPDs is based upon Excel.

3 Material

The project 'Environmental Database and Environmental Product Declarations for Furniture' has the goal of developing EPDs for at least 80% of Norwegian furniture. It consists of two subprojects:

1. Establishing an environmental database for Norwegian/Nordic furniture.
2. Preparation of Product Category Rules (PCR) for Environmental Product Declarations (EPD) for furniture.

Four pilot companies – Ekornerne Møbler AS, Jensen Møbler AS, Helland Møbler AS, HÅG AS – have developed an LCI-database and a few pilot EPDs (NEPD 2005). Two of the companies have environmental management systems in compliance with ISO 14001. As a part of the project, the companies will expand their EMS to also include the development of EPDs.

4 Results Sub-Project 1 'Establishing an environmental database for Norwegian / Nordic Furniture'

Performing an LCA is a time consuming task which, for an SME, is practically impossible to carry out without expert assistance. The main goal in sub-project 1 is to establish an LCI-database for Nordic furniture production that facilitates the LCA required in EPDs. It is further intended that the database will assist the companies' internal R&D efforts. Main activities in sub-project 1 have been to identify actors and gather information on sub-suppliers and the products they supply to the furniture industry; further to describe product systems and acquire existing environmental data (e.g. LCI); and finally to specify data requirements and the formats for the database.

The database must make it simple to model a product as a combination of components and processes and the amount of each (weight, number of pieces, hours of work, etc.). A set of predefined components shall be provided according to the needs of the furniture industry. Examples of components may be materials like woods, metals, foam, fibre, nuts, and bolts, or processes like energy usage, work hours per model, transportation. The output from the database must

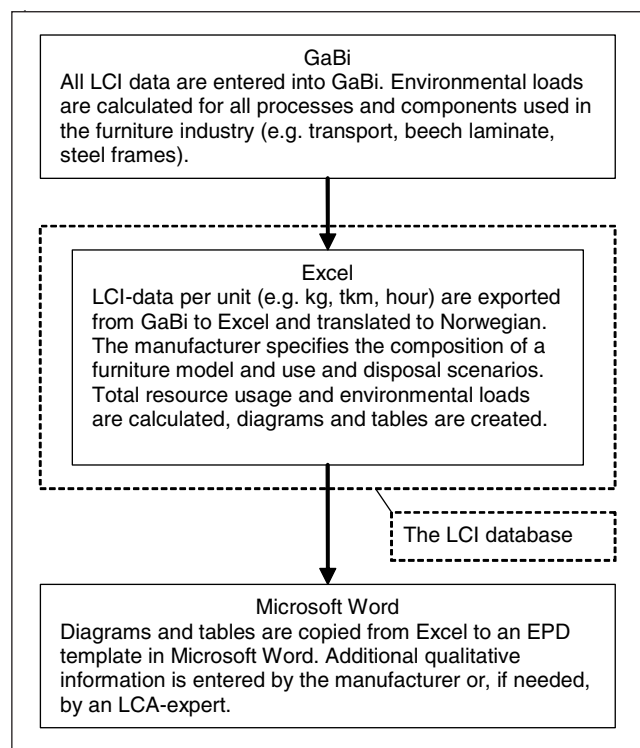


Fig. 1: The LCI-database with information flows in/out of the database

be 'ready to use' for creating an EPD, according to the PCR. It is essential that the interface to the database be as simple as possible. The database with its input and output is illustrated by Fig. 1.

All LCI data are entered into the life cycle assessment tool GaBi (PE Europe GmbH 2005). The hierarchic structure is based on existing data provided in GaBi. LCI-data gathered in previous projects (Fet et al. 2003) are also included in this database. Environmental loads are first calculated using the CML2001 method that is provided with GaBi and then entered into an Excel spreadsheet. The composition of a furniture model is specified in Excel, and the total environmental loads for the furniture are then calculated. This information is the basis for creating an EPD in Microsoft Word format. The process is shown in Fig. 1. The reason for using Excel and Word was to allow the furniture companies to use programmes that they already had licensed and knew how to operate.

Among the most time-consuming activities during the establishment of the database, was the gathering of furniture-specific environmental data, and also to determine the best allocation procedures. Standard user and disposal scenarios for the furniture were defined and entered into the database.

Fig. 2 is an example of how the database front-end will be for a furniture manufacturer. In the figure, a piece of furniture – in this example a reclining chair – is modelled as a combination of materials and processes. The underlying LCI-data imported from GaBi are used to calculate the total en-


Chair I						
Product category	Seating					
Seating maintained for 15 years						
Number of seats	1					
Period [year]	15					
Disposal scenario	Scenario II					
Product lifetime	15 years					
Product composition						
Description	Material/ process	Amount	Material Specif- ication	# of parts	Waste [%]	Total
Frame						
Chair legs	Steel I	1.4	Steel	1	1	1.414 kg
Backrest	Aluminium	0.6	Aluminium	1	1	0.506 kg
Seat						
Upholstery	Textile, wool	0.65	Textiles	8		0.702 kg
Nails	Steel II	0.029	Steel	2		0.03 kg
Production	Prod	3.5				3.5 hrs

Fig. 2: Creating a furniture model

Table 1: Comparison of two products

	Chair 1	Chair 2
Ozone depletion potential (ODP)	5.64E-05	3.78E-05
Eutrophication potential (EP)	0.21	0.32
Global warming potential (GWP100)	384.87	445.81
Acidification potential (AP)	1.29	2.00
Photochem. Ozone Creation Potential (POCP)	0.25	0.24
Heavy metals (EI95)	0.16	0.16

vironmental load. Table 1 shows how two products (or variations of one) can be compared against each other by means of different performance indicators. Information about functional unit, system boundaries, data quality requirements, and additional environmental information as required by the PCR, see next section.

5 Results Sub-Project 2. 'Preparation of PCRs and EPDs for Furniture'

The project goal is to prepare PCR for the selected product groups (plain chairs, reclining chairs, and mattresses), and further develop EPDs for 80% of Norwegian furniture. The PCR will lay the foundation for the EPDs.

5.1 PCR-requirements to content and the development procedures

The most relevant background document for the establishment of PCR is the ISO/CD 14025.3. However, the PCR-document developed for furniture (NHO 2005) is based upon information in the technical reports from previous LCAs (Dahlsrud et al. 2002a, Dahlsrud et al. 2002b, Brekke and Klæboe 2001), on information from the Nordic Swan labelling system for furniture (Nordisk Miljømerking 2003) and on the requirements to labelling of furniture and mattresses given by the EU Commission (Deliege and Nijdam 2002).

The development of a PCR-document should follow the steps

1. define product category
2. produce appropriate product category LCA
3. specify rules, parameters and requirements for reporting, and how to produce the data required for the product declarations

The PCR-document must contain the information listed in Table 2.

Due to the differences in the functional units for each pilot model studied in the project, three PCR-document are made. However, much of the information is similar for each of the PCR-documents, and the PCR-documents developed in the project are kept as short as possible, although they must still allow for variations in different product segments.

5.2 EPD-format and content

According to Table 2, i), the PCR-document shall also give instruction to the EPD content and format. Relevant documents for the EPD-format are the reports from the Nordic Project on Implementation of Environmental Product Declarations (the NIMBUS-project) which give examples of Nordic EPD-forms (Hanssen et al. 2001, Solér 2001). EPDs retrieved from the GEDnet website (GEDnet 2005) show that there is considerable variation in the EPD format throughout the world, even within Norway there is considerable variation (STØ 2003, Byggforsk 2004). The chosen EPD format is based on the most common Norwegian EPD format, which is also used in the furniture industry (STØ 2004).

Table 2: The content of a PCR document (International Organization for Standardization (ISO) 2004)

a	The product category description (e.g. functional qualities, technical performance and use)
b	Materials and substances to be declared (e.g. information about product content in terms of specification of materials and list of chemical substances that can adversely affect human health and the environment, in the production, use and disposal stages of the life cycle)
c	Goal and scope for the product category LCA, according the ISO 14040 series, including functional unit, system boundaries, description of data categories, criteria for the inclusion of inputs and outputs, data quality requirements, units
d	Inventory analysis including data collection and calculation procedures, allocation of material flows and releases
e	Impact assessment category selection and calculation rules, if applied
f	Pre-determined parameters on which LCA data should be reported (inventory data categories and impact assessment category indicators)
g	Rules on additional information, including any methodological requirements (e.g. specifications on risk assessment)
h	Instructions for producing the data required to create the declaration (LCA and additional information) for the declaring body
i	Instructions on the content and format of the Type III environmental declaration
j	Information about whether the declaration is based on a full life cycle and, if not, information on which these stages are not considered and justification for these omissions

Table 3: Information to be included in the EPD (Confederation of Norwegian Business and Industry (NHO) 2005)

• Description of manufacturer or service provider
• Description of product
• Product identification (e.g. model number)
• Name of the programme and the programme operator's address and, if relevant, logo and website
• Date of publication
• LCA results (may include information about raw material acquisition, energy use and efficiency, content of materials and chemical substances, pollutant emissions to air, soil and water, waste generation and the environmental impact associated with the product or service in question)
• Content declaration (materials, substances)
• Information that briefly defines the nature of the review and the verification process
• If the declaration is based on information modules, a statement that it does not cover the whole life cycle
• A statement that environmental declarations from different programmes may not be comparable

Table 3 lists the information to be included in an EPD. In addition, the EPD can also contain information about service and maintenance, what the owner/user can do to further reduce the environmental impact, information on reuse and recycling as well as guidance on disassembly and waste handling. Information about the environmental management work by the importer, manufacturer or retailer may also be useful to include. All EPDs in a product category shall follow the same format and include the same data as identified in the PCR provided by the programme operator. If the EPD is a module environmental declarations (e.g. cradle-to-gate and gate-to-gate EPDs), this shall be clearly stated in the declaration.

Several pilot EPDs have been carried out in Norway. They follow the format suggested through the NIMBUS-project (Hanssen et al. 2001). The EPDs for Norwegian furniture have been published online by NEPD (NEPD 2005). This is in conformance with the requirements listed in Table 3. However, after gaining more experiences with the database in sub-project 1, the indicators that are used to present the environmental performance can be adjusted.

5.3 EPD programmes, review of PCR and verification of EPD

An additional goal of this work is to stimulate the establishment of a verification system for EPDs. In developing a Type III EPD programme, the rules for verification shall be set up in accordance with ISO 14025, ISO 14040 and ISO 14020. A verification procedure shall include the format of verification, its documentation, verification rules and verification results. For verification of EPDs, the verifier shall verify the quality, accuracy and completeness of the data, and in addition, the conformance to the PCR. The verification of LCA data in the EPD shall, at a minimum, confirm conformance with the PCR and the ISO 14040 standards.

5.4 EPD-verification in Norway

The Industry Foundation for Environmental Declarations in Norway (hereafter called *the Foundation*) is the owner and the responsible body for the Norwegian Type III EPD programme. The responsibilities for the Foundation are (amongst others):

1. Preparing, maintaining and communicating general EPD-programme instructions;

2. managing the development of pcr and maintaining an overview of these;
3. approving and registering type iii environmental declarations, and maintaining the register of such;
4. gathering professional information for the creation of pcr and epd;
5. monitoring changes in similar EPD programmes.

Verification of the EPD by an independent third party is required in the Norwegian EPD-system, and the verifier must be approved by the Foundation. Today, a list of approximately 15 approved verifiers exists. The EPD is valid for a limited time period only, after which it must be revised if its validity is to be extended. A critical review is also necessary if there are any changes that significantly affect the LCA results. The issuing company is responsible for carrying out the review.

According to ISO 14025 (ISO 2004a), it is possible for independent verification of the EPDs to be carried out by the companies own environmental auditors, provided that the company has an ISO 14001 or EMAS-certified environmental management system and that the certification body has approved the LCA routines as part of the management system.

The Foundation has encouraged three companies to put this into practice. One of these companies, Helland Møbler AS in Stordal, has included such a procedure in their ISO 14001 management system. This has been done as part of their involvement in the project presented above. The company has an integrated management system for occupational health, safety and environment (indoor/outdoor) (HSE), and was certified after ISO 14001 in January 2003. Since 2003, the company has worked out EPDs for approximately 80% of their products. The verification of the EPDs is now a part of their ISO 14001-audit where the following procedures in their management system are central:

- Procedure for identification of environmental aspects of one's own products;
- procedure for performance lca of one's own products;
- procedure for achieving environmental product information at sub-suppliers;
- procedure for the development of EPDs.

The certification body NEMKO verified the procedures and ensured that the company, based on these documents, is able to fulfil the requirements in ISO 14020, ISO 14025 and ISO 14040.

6 Discussion

The main issues presented in this paper are the development of the furniture-specific LCI-database and data-assistant support tool for making EPDs, the development and content of PCRs and EPDs, and, finally, the verification system for such.

One of the main challenges regarding the LCI-database was the gathering and documentation of sufficient specific data. According to the requirements of NEPD, at least 90% of the contribution to the total environmental impact must stem from site-specific data (NEPD 2004). Data for the production of resources are considered specific if they represent similar technological and geographical situations and the system boundaries are identical. The database consists of company-specific data for the assembly processes and for the majority of the sub-supplier production. The rest is based upon data from other databases, complemented with literature data for the production of a number of renewable materials not found elsewhere (e.g. textiles). Another challenge regarding the database was the operation of it by the user in the industry. This has been solved by using Excel as the front end for the data-assistant tool, which has the advantage of having a familiar user interface. The front end has been designed so that knowledge of LCA or environmental management systems is not needed to create an EPD. The drawback of choosing this solution is that flexibility is lost compared to developing customised software and that the software is not platform independent.

Additionally, data access must be controlled so that confidential industrial information is not disclosed. This has been solved by creating individual sets of data for each participating company, in the form of a company unique Excel database. Although this approach keeps the data confidential, it is cumbersome to upgrade database content. This can be solved by creating a password protected central database, with individual access levels.

The content of the PCR-documents that have been developed in this project is in accordance with ISO/DIS 14025.3. This standard gives detailed – at times unstructured – information on what the PCR should contain. The standard does not state the format of the PCR document in detail. Comparing the PCR-document developed in this project with other PCRs, it is clear that some PCR-documents have more detailed format requirements (JEMAI 2004), whilst others have less (SEMC 2003). There is still work to be done on making the PCR-documents easier to read and use, and also to develop a common PCR-document for furniture that can be used for the different product segments. This document should be harmonized with similar PCR-documents in other countries, of which there currently are none registered at GEDnet (GEDnet 2005).

The format of the EPDs that are developed in the project follow the NIMBUS-format (Hanssen et al. 2001). This format differs from the format used, for example, for construction material (Vold and Fossdal 2003). In addition to tables and diagrams, the EPDs for the furniture present the main results by a set of performance indicators making it easier to compare different products against each other, and easier to interpret the information for non-experts. These indica-

tors give information about the general environmental impact of the product, but they do not say anything about site-specific impacts or potential negative health effects from use of the product. This is a topic for further discussion. As several products belong to a product family, the development of group-EPDs has been discussed in the project, and two pilot EPDs for series of products are developed (NHO 2004a). A product-series EPD is intended for a range of similar products, for example variations of one type of chair. If several products are included in one EPD, it is intended that they have the same functional unit and similarities in design and manufacturing processes. However, this is not included in the ISO/CD 14025.3, even if there are no obstacles that say they cannot be developed. To reach the project-goal of EPDs on 80% of Norwegian furniture, a challenge is therefore to use group-EPDs in addition to EPDs for single products.

Another aspect to take into consideration is the discussion about module declarations. It is well known that LCA-data for all materials used, for example in furniture, is not yet available. In addition, end-of-life treatment of furniture is difficult to control, and often scenarios are used to present the entire life cycle of a product. To avoid the discussion around adding EPDs from cradle-to-gate and gate-to-gate up to 'cradle-to-grave'-declarations, the database can be used to add the information and thus present updated EPDs accordingly.

If the information in the EPDs is to be trusted, a good verification system must be in place. The independent verification of an EPD and the underlying LCA data is required according to the NEPD guidelines (NEPD 2004). Although this ensures a thorough review of both the EPD and the underlying LCA data, it may be an ineffective approach in the furniture industry, where most products within one company are made from the same materials provided by the same sub-suppliers. This means that the same LCA data are verified for each consecutive EPD. An alternative solution may be to allow for a verification of entire databases. This approach will make the verification of the underlying LCA both more time efficient and less costly. The cost considerations are especially important as many of the furniture manufacturers are in the SME sector.

7 Conclusions

This paper shows how environmental product declarations (EPD) are made in the Norwegian furniture industry. Through the use of a common LCA database and an accompanying data-assistance tool, a number of EPDs have already been published. Although the database and accompanying data-assistant tool fulfil their purpose, it has become clear that the database should also be connected to economic and quality systems in the furniture companies. This has also been requested by the furniture industry, after experiences from working with the database. An upcoming project for the same group of companies will focus on this in the next years.

PCR documents covering four product categories within the furniture industry have been developed. The experiences from this work show that it would be beneficial to combine these into one common PCR document for the furniture industry,

with additional product category specific information. This will make it easier to create module EPDs.

The existing verification system ensures a thorough verification of both the EPD and the underlying LCA data, but it also requires that the same LCA data are verified several times. This may be alleviated by allowing for a verification of databases. Such an approach may aid SME companies into the EPD market, by making the LCA more cost-efficient and increasing data availability.

The project referred to in this paper has been driven by the companies. In their efforts of answering the requests from their customers on the documentation of environmental performance of their products, the presentation of EPDs has been an effective way of meeting this challenge. Instead of answering long questionnaires from their customers, the EPDs have been included in their contract bids. However, the understanding of the information presented in an EPD is not always straight forward; additional information to the purchasers is still needed. Information about the EPD-system, in general, is also needed.

An additional advantage for the companies has been to use the experiences gained through the project to become more environmentally conscious regarding future product design and development. Now they also see the need of doing such improvements not only at their in-house production facilities, but also upstream in the supply chain.

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